

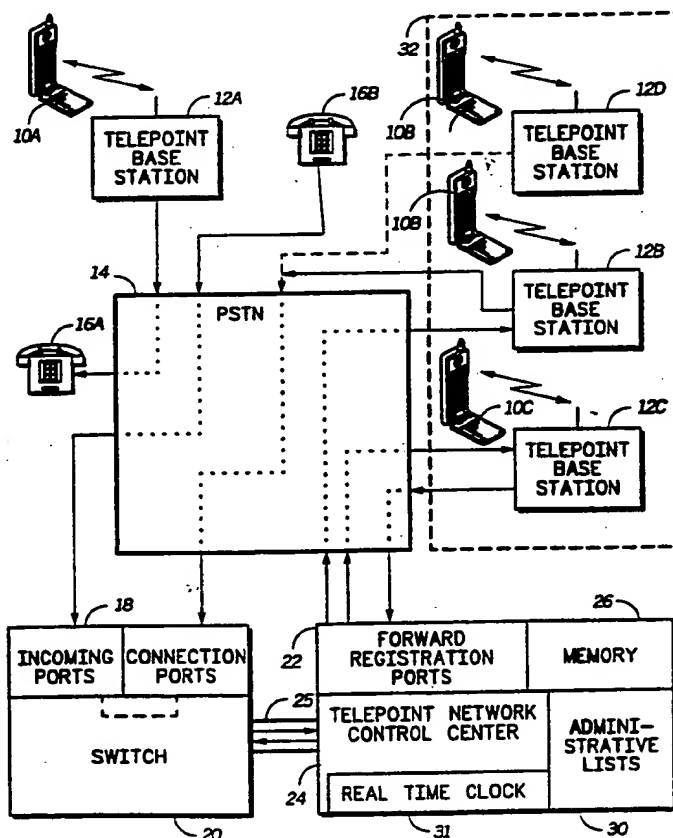


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**FILED WITH
APPLICATION****(54) Title: CORDLESS COMMUNICATION SYSTEM SUPPORTING CALL FORWARDING****(57) Abstract**

A communication unit (10) is prompted by a base station (12) for call forwarding information whenever the communication unit (10) deregisters from the base station (12). Thereafter, calls for the communication unit will be forwarded in accordance with the call forwarding information provided by the communication unit or in accordance with default call forwarding data.



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CORDLESS COMMUNICATION SYSTEM SUPPORTING CALL FORWARDING

Field of the Invention

This invention relates in general to radio communications systems, and in particular to a wireless telecommunication system support call forwarding to communication units.

Background of the Invention

In those communication systems that limit incoming communication to users that are registered on a site (or portion) of the communication system, there exists a problem in that unregistered communication units generally cannot be located or contacted to receive an incoming call. For example, current proposals for second generation cordless telephone systems (CT-2) utilize several radio frequency (RF) channels for communication between communication units (e.g., cordless telephones or CT-2 communication units) and a base station coupled to the public or private switched telephone network (PSTN). In such a system, the user may receive an incoming telephone call via a telepoint base station after the communication unit has registered. Registration is typically accomplished by establishing an RF link between the communication unit and the telepoint base station which is coupled to the PSTN. The telepoint base stations typically provide telecommunications within approximately 150 meter radius of the station depending upon terrain and other obstructions that may interfere with the signalling.

After registration, a communication unit may receive an incoming call by scanning the available RF channels to find a telepoint station polling for the communication unit, and then may access the telepoint station via this channel. The telepoint station, likewise, scans the available channels for outbound

calls from the communication units, and when the telepoint station detects a call request from a communication unit, interconnection with the PSTN is provided.

Overall system control in a CT-2 communication system is reserved to a telepoint network control center that provides periodic supervision of the telepoint base stations. To do this, the network control center periodically contacts (via the PSTN) each telepoint base station and provides each station with system administrative lists (e.g., a list of units that should be prevented from operating due to theft of the unit or other reasons). Likewise, each telepoint station periodically (e.g., once a day) interconnects with the network control center via the PSTN to download communication unit activity for network billing.

Accordingly, it will be appreciated that CT-2 communication systems approximate the convenience of cellular telephones at a reduced cost to both the service provider and the consumer. However, telepoint station operation has been primarily limited to one way communications originating from the communication unit unless the communication unit has registered at a telepoint station so that the communication unit may receive incoming calls. Unregistered communication units generally cannot be contacted to receive a call. Accordingly, it would be desirable to have a technique for re-routing a call for a deregistered communication unit so that important calls or communication is not frustrated by the operation of the communication system.

Summary of the Invention

Briefly, according to the invention, a communication unit is prompted by a base station for call forwarding information whenever the communication unit deregisters from the base station. Thereafter, calls for the communication unit will be forwarded in accordance with the call forwarding information

provided by the communication unit or in accordance with default call forwarding data.

Brief Description of the Drawings

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Figure 1 is a diagram of communication system in which the present invention may be advantageously employed.

Figures 2a and 2b are flow diagrams illustrating the operation of the telepoint base stations in accordance with the present invention.

Figures 3a-3c are flow diagrams illustrating the operation of the network control center in accordance with the present invention.

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Detailed Description of the Invention

Referring to Figure 1, there is shown a radio communication system designed to interface wireless communication units 10, such as second generation cordless telephones (CT-2), with a public or private switched telephone network 14. To initiate a cordless telephone type call, a communication unit 10a establishes a radio frequency link with a telepoint base station 12a. The telepoint base station 12a couples to the PSTN 14 thereby allowing information to be passed from the communication unit 10a to the PSTN 14 to call (for example) a telephone 16a.

Conversely, a telephone call may be made from a conventional telephone 16b to a communication unit 10b, which has registered at a telepoint base station to receive incoming calls, by calling a telephone type identification number corresponding or associated with the communication unit 10b. Preferably, system access is implemented by assigning each communication unit 10 in the system its own unique telephone type number, just as if the communication unit 10 were a telephone instrument hard-wired to the PSTN 14. In this way,

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the numbers assigned to the communication units 10 would be routed by the PSTN 14 to incoming ports 18 of a telephone type switch 20 of the communication system. The switch 20 can be a devoted system switch or may comprise a conventional
5 electronic telephone switching arrangement within a central telephone office. The incoming ports 18 of the switch 20 ultimately become coupled to one of a plurality of connection ports 22 to await connection with the communication unit 10b. Preferably, an audible ring back signal (or equivalent) is
10 provided to the caller as the switch 20 communicates with the telepoint network control center 24 via a data link 25 prior to the establishment of the communication link.

In the exemplary communication path illustrated in Figure 1, the switch 20 informs the network control center 24 of the
15 presence of an incoming call for a communication unit 10b via the data link 25, after which the network control center 24 determines the location of the communication unit 10b from the registration information in the memory 26. As soon as the network control center 24 has determined the location of the
20 communication unit 10b, the telepoint base station 12b associated with the communication unit is contacted by the network control center via the PSTN and is instructed to poll for the communication unit 10b. Upon successfully contacting the communication unit 10b, the telepoint base station 12b
25 completes a call-back sequence so as to connect the communication unit 10b with the appropriate connection port 22.

According to the invention, the communication unit 10b has at least default call forwarding information stored in a memory
30 26, that the telepoint network control center 24 can provide to the PSTN to route incoming calls intended for a deregistered communication unit to any wireless or conventional wireline communication unit. In this way, the PSTN can route incoming calls away from the communication system to another telephone
35 (or equivalent) since the communication system would be incapable of contacting the deregistered or unregistered

communication unit. Preferably, the default call forwarding information is stored within the network control center when the communication system is programmed to recognize the communication unit. Optionally, the default call forwarding information may be stored, changed, or updated at any time via
5 accessing the memory 26 via any conventional personal computer or terminal.

According to the invention, a communication unit may deregister while operating within the communication system,
10 which effectively prevents the communication unit from being located or contacted. Deregistration can take place automatically, such as a deregistration from one base station when a communication unit subsequently forward registers in a second location. Additionally, automatic deregistration may
15 take place at a predetermined time (e.g., every day at midnight for example) as determined by a real time clock 31. Moreover, the present invention contemplates that a communication unit 10c can indicate a temporary or future deregistration time when forward registering. For example, if a communication unit user
20 is going to be at a restaurant for two hours he/she can input the time at which deregistration is to be effected (i.e., two hours from the current time), or a time period after for which he wishes to deregister (i.e., for the next two hours after which the communication unit re-registers). The network control center
25 24 compares the time indicated as a time of deregistration with the time indicated by the real time clock 31 and erases or deletes the forward registration information from the memory 26 upon coincidence. Administrative lists are stored in a memory 30 for access by the telepoint network control center.
30 24 in a conventional manner.

A communication unit may also deregister manually at any time. To do this, an RF link is established between the communication unit and the telepoint base station which is coupled to the PSTN. The RF link enables the communication unit
35 to transmit a deregistration command or request that renders any prior registration ineffective (e.g., the prior registration

may be deleted, erased or merely ignored). When a manual deregistration occurs, the communication unit is prompted via a transmission from the base station to transmit any desired call forwarding information (if different from the default information) so that the network control center can program or send the call forwarding information to the PSTN. In this way, the conventional PSTN call forwarding switching is automatically programmed by the network control center to divert future incoming calls away from the system and to another telephone (or equivalent) since the system cannot locate the now unregistered communication unit to deliver a call. Of course, if the default call forwarding information is sufficient, no additional information need be sent by the communication unit.

15 A deregistered communication unit (10c) can also re-register (or forward register) by establishing an RF link with a telepoint base station 12c and calls a predetermined access number. The telepoint base station forwards information identifying the communication unit 10c and the telepoint base station 12c to a forward registration port 28 coupled to the telepoint network control center 24. The telepoint network control center 24 provides this information to the PSTN and also stores this information in the memory 26. Once a communication unit has registered, the network control center contacts the PSTN and automatically cancels any call forwarding programming (either default or otherwise). Thereafter the PSTN will route incoming calls to the switch 20 so that the network control center can route the incoming call to the now registered communication unit.

30 In the preferred embodiment of the invention, the memory 26 maintains an electronic listing of any registration data transmitted from each communication unit operating within the communication system. Also, default (or particular) call forwarding information is associated within the memory 26 for each communication unit. In this way, the network control center 24 can either process incoming calls in accordance with

the registration data or automatically program the PSTN to call forward incoming calls to an alternate communication system (e.g., conventional land line, cellular, etc.). This process facilitates the processing of incoming calls and minimizes the time a system user is incapable of receiving a call because his/her communication unit is currently not registered on any telepoint base station.

To accommodate registered communication units that are carried within a single geographic area, such as a shopping mall or an airport, yet may enter and leave the range of a single telepoint base station 12b, a plurality of telepoint base stations 12b, 12c, and 12d, together covering the single geographic location 32 are preferably wired together via a data link 34. If the telepoint base station 12b does not locate the communication unit 10b after a sufficient time, information can be passed via the data link 34 to the telepoint base stations 12c and 12d. Telepoint base stations 12c and 12d can then attempt to locate the communication unit 10b. Therefore, if communication unit 10b has moved to the coverage area of telepoint base station 12d (represented in broken line as communication unit 10b'), the telepoint base station 12d can couple the communication unit 10b' to connection port 22 in the manner described above. Therefore, a user of a communication unit operating within a limited geographic subset of the communication system does not have to continually re-register every time he/she moves from the coverage area of a telepoint base station 12.

Figures 2a and 2b depict the operation of the telepoint base stations 12 (FIG.1) to effect the present invention. In addition to its normal call searching and call maintenance functions, the base stations look for deregistration requests or commands from the various communication units. If a deregistration signal is detected (decision 50), control is routed to the flow illustrated in Figure 2b. Conversely, if a communication unit registers (reregisters) on a base station, (decision 52) the network control center is contacted via the PSTN and the

communication unit's identification information is sent for storage in the memory 26 of Figure 1 (step 51). Additionally, the base station's identification is also sent to the network control center so that the communication unit can be found by the network control center.

Assuming that the determination of decision 50 was that a deregistration signal was received, the base station operates to prompt the deregistering communication unit to provide call forwarding information as to where future incoming calls should be directed (step 54). If the base station does not receive this information (such as within a predetermined time interval) the default call forwarding information will automatically be used by the network control center (see Figures 3a-3c). In any event, the deregistration information is forwarded by the base station to the network control center (step 56). Additionally, if the deregistering user has provided any call forwarding information (decision 58), this information is also sent to the network control center (step 60).

Figures 3a-3c illustrate the network control center's operation when a communication unit registers (decision 62) or deregisters (decisions 64 and 66) within the communication system. If a base station transmits registration information to the network control center, the information is stored in a memory 26 of Figure 1 (step 68) and any prior call forwarding information sent to the PSTN is cancelled (step 70). Conversely, if a communication unit manually deregisters, the network control center looks to see if call forwarding information is forthcoming (decision 72). If so, the call forwarding information is sent to the PSTN (step 74). Alternately, should an automatic deregistration be effected by the network control center (decision 66), or if no forward registration information is received (decision 72), the network control center sends the default call forwarding information to the PSTN (step 78).

In summary, communication units are prompted by a base station for call forwarding information whenever they deregister from a base station. Thereafter, calls for the

communication unit will be forwarded in accordance with the call forwarding information provided by the communication unit or in accordance with default call forwarding data. In this way, incoming calls will be properly routed to alternate
5 communication destinations whenever the communication unit is not registered for receiving incoming calls.

CLAIMS

1. A method for routing an incoming call intended for a wireless communication unit, comprising the steps of:

- 5 receiving a signal representing a request or command to ineffectuate a prior registration of a communication unit; transmitting a request to receive information representing call forwarding data; routing incoming calls in accordance with the information representing call forwarding data when the information is provided by the communication unit, and routing incoming call in accordance with default call forwarding data when the information is not provided by the communication unit.

- 15 2. The method of claim 1, wherein the routing step comprises the step of programming a telephone network with the call forwarding data when the information is provided by the communication unit, and programming the telephone network with default call forwarding data when the information is not provided by the communication unit.

- 25 3. The method of claim 1, wherein the routing step comprises the step of sending the call forwarding data to a telephone network when the information is provided by the communication unit, and sending the default call forwarding data to the telephone network when the information is not provided by the communication unit.

- 30 4. The method of claim 1 which includes the steps of receiving a signal representing a request or command to register a communication unit.

- 35 5. The method of claim 4, which includes the step of cancelling any prior call forwarding information sent to a telephone network.

6. The method of claim 4, which includes the step of reprogramming a telephone network to direct incoming calls to the communication unit.

5 7. A communication system capable of routing an incoming call intended for a wireless communication unit, comprising:
 means for receiving a signal representing a request or command to ineffectuate a prior registration of a communication unit;
10 means for transmitting a request to receive information representing call forwarding data; and
 means for routing incoming calls in accordance with the information representing call forwarding data when the information is provided by the communication unit, the routing
15 means also capable of routing incoming calls in accordance with default call forwarding data when the information is not provided by the communication unit.

20 8. A communication unit for operating in a communication system capable of routing an incoming call to a wireless communication unit, comprising:
 means for transmitting a signal representing a request or command to ineffectuate a prior registration of a communication unit; and
25 means for receiving a request to receive information representing call forwarding data.

30 9. A method for routing an incoming call intended for a wireless communication unit, comprising the steps of:
 automatically determining to ineffectuate a prior registration of a communication unit;
 routing incoming calls in accordance with default call forwarding data.

10. The method of claims 9 which includes the steps of receiving a signal representing a request or command to register a communication unit.

5 11. The method of claim 10, which includes the step of reprogramming a telephone network to direct incoming calls to the communication unit.

10 12. A communication system capable of routing an incoming call intended for a wireless communication unit, comprising:
 means for automatically determining to ineffectuate a prior registration of a communication unit; and
 means for routing incoming calls in accordance with default call forwarding data.

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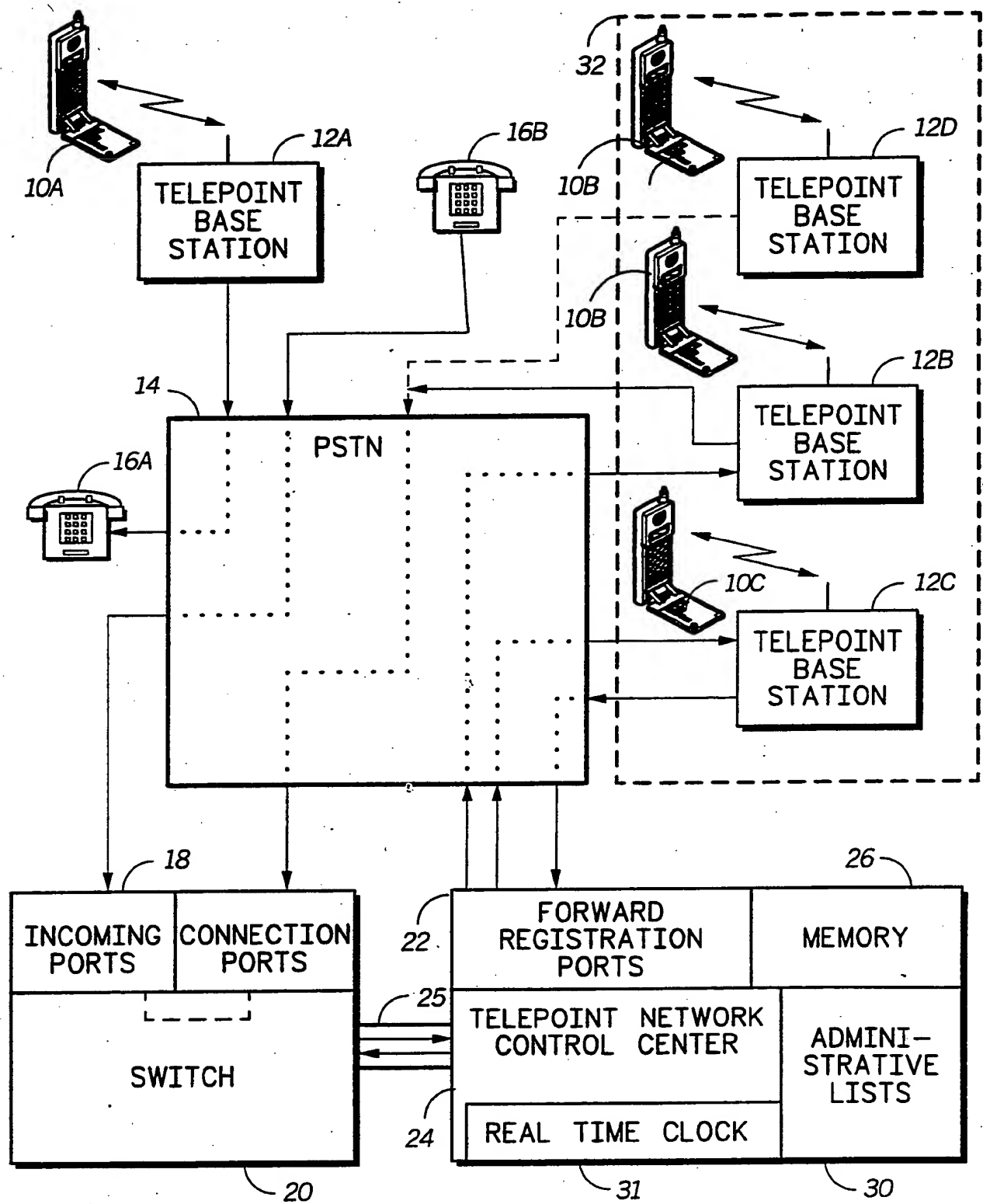
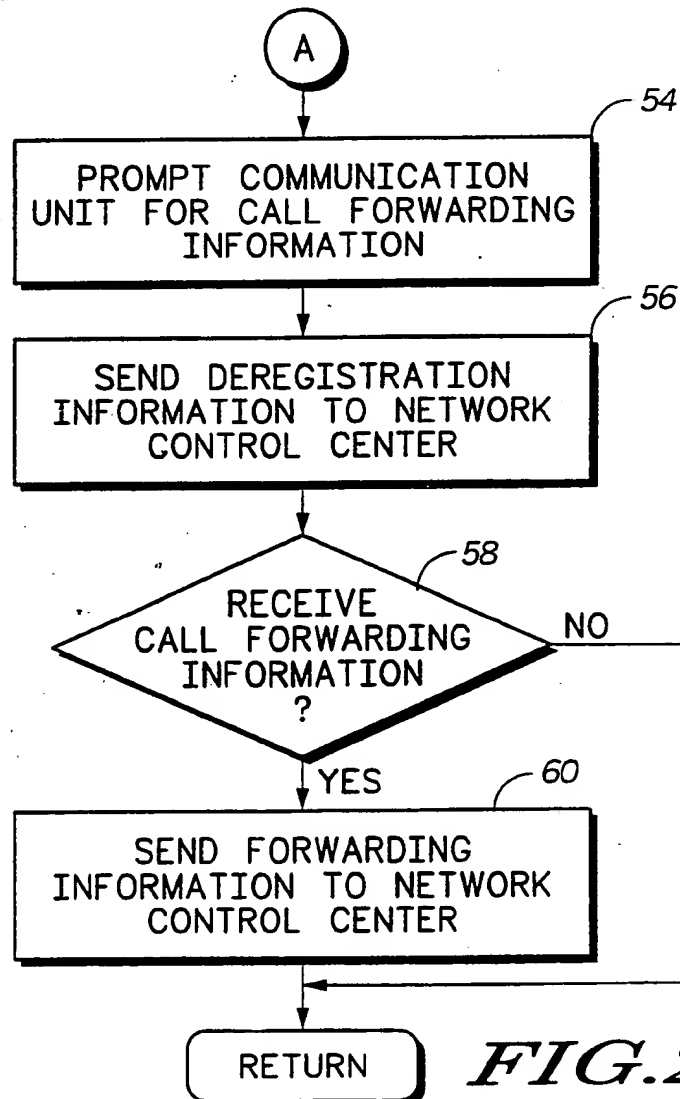
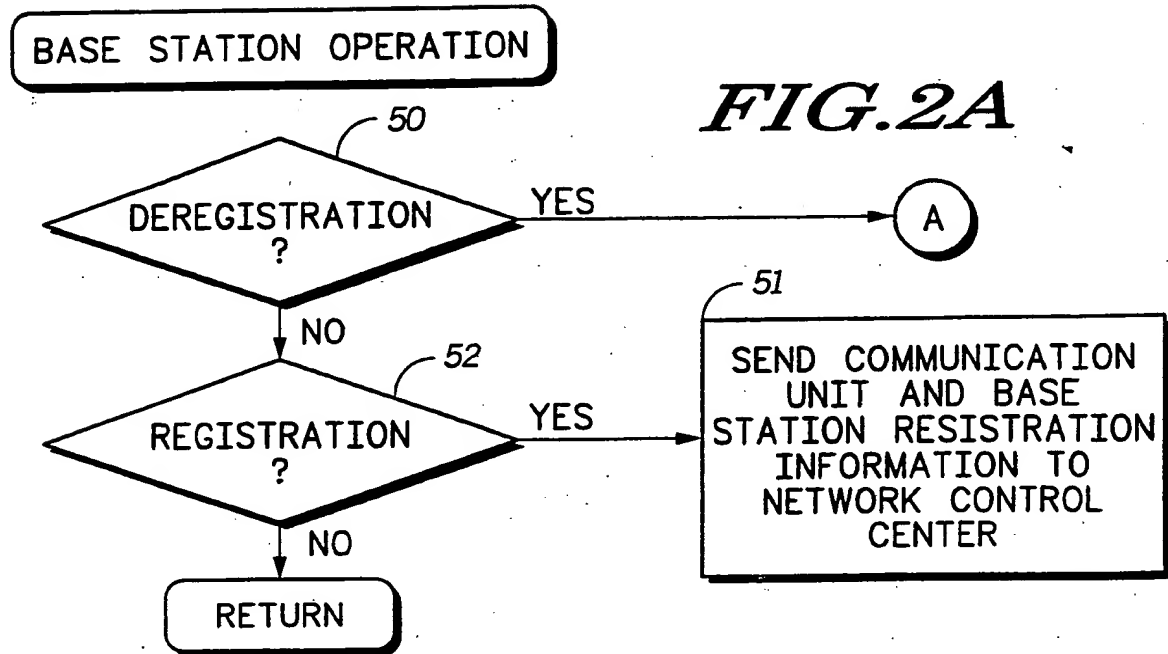
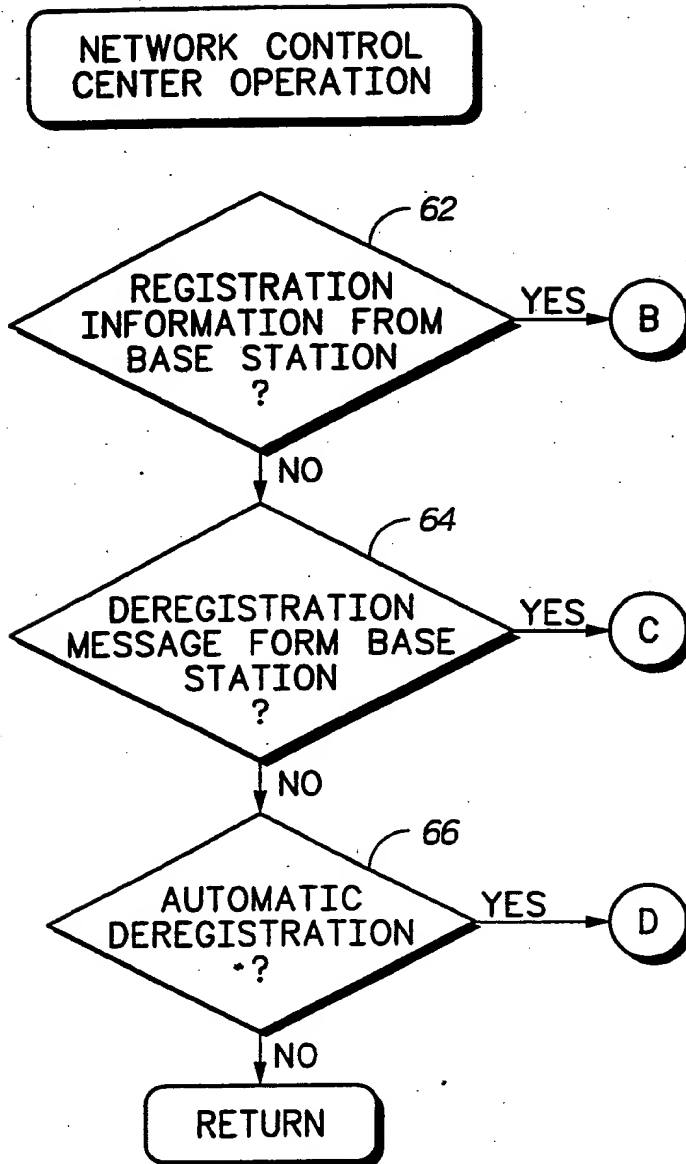
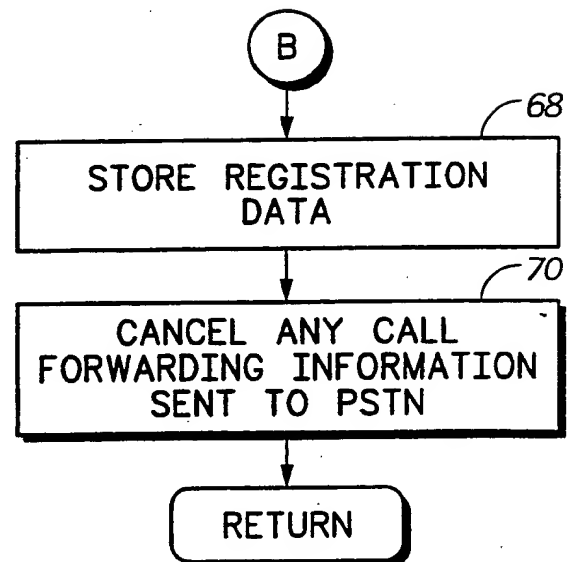


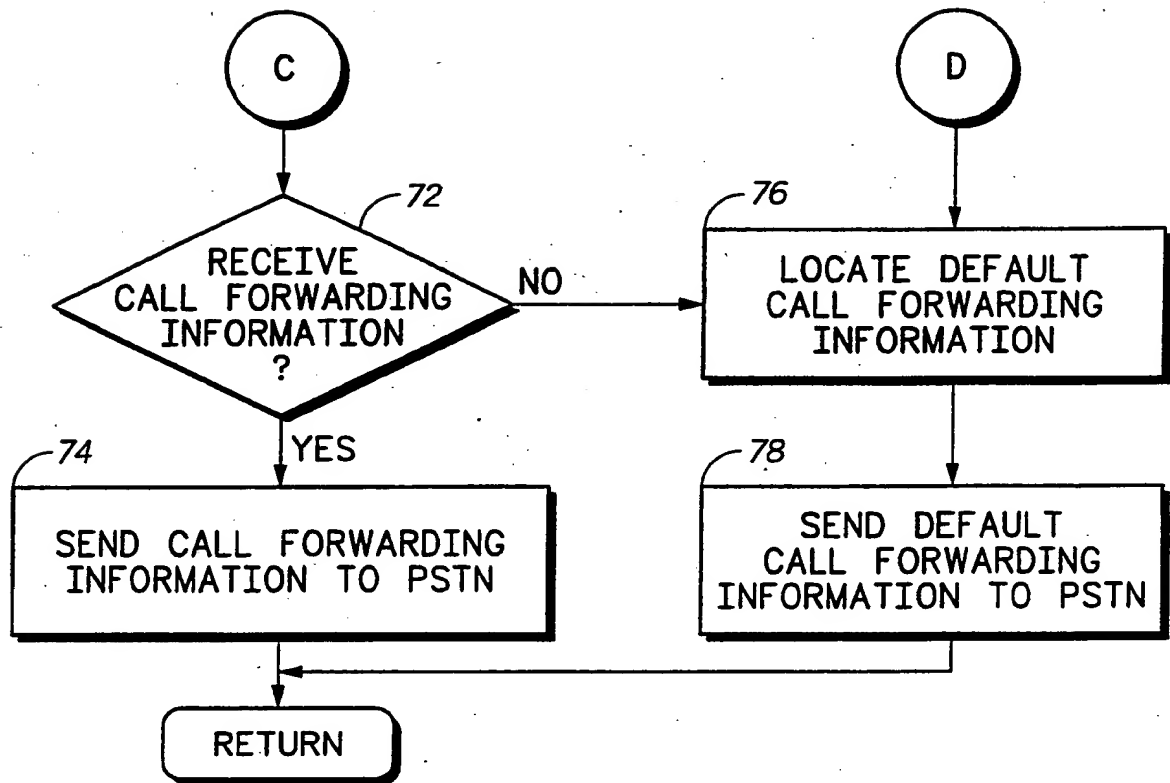
FIG. 1

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**FIG. 3A****FIG. 3B**

*FIG. 3C*

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/05289

I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) and both National Classification and IPC

IPC(5) H04B 1/00

U.S. Cl. 455/54

II. FIELDS SEARCHED

Minimum Documentation Searched

Classification System

Classification Symbols

U.S. CL. 455/39, 49, 53, 54; 379/56, 58, 59, 60, 63

Documentation Searched other than Minimum Documentation
to the extent that such documents are included in the Fields Searched

III. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. *
X Y	US, A 4,512,016 16 APRIL 1985 see figs. 3,4,6-14,16	12 1-11
X Y	US, A 4,512,017 16 APRIL 1985 see figs. 3,4,6-14,16	12 1-11
X Y	US, A 4,829,554 09 MAY 1989 see figs. 1,2A,2B,2C,2D,7A,8B,9,12A 13A-13D,14A-14B col. 13,1.60 to col. 14,1.18 col. 21,1.49 to col. 23,1.7	1,7,12 2-6,8-11
X Y	US, A 4,833,701 23 MAY 1989 see fig. 1-5. col. 6, 1.56 to col. 7,1.37	12 1-11

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IV. CERTIFICATION

Date of the Actual Completion of the International Search

24 OCTOBER 1991

International Searching Authority

ISA/US

Date of Mailing of this International Search Report

14 NOV 1991

Signature of Authorized Officer

WILLIAM CUMMING

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